An Organizational Coordination Model of Salesforce Compensation Plans: Theoretical Analysis and Empirical Test

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1. INTRODUCTION
The design of a good salesforce compensation plan is an important task facing most firms. Salesforce-related expenses typically account for the largest category of selling expenditures incurred, including media advertising (FTC, 1982). Industry studies (for example, Ford, Walker, and Churchill) find that managers believe compensation practices are among the strongest tools available to them to enhance the productivity of their salesforces. In addition, the observed patterns of salesforce compensation (see Peck) show a great deal of variation across firms with respect to the use of different types of compensation (salary, commission, bonus, and so on).

In spite of the acknowledged importance of salesforce compensation plans, little theoretical analysis has been directed at this issue. One line of theoretical inquiry that has been offered recently is the model developed by Basu and his coauthors. They apply Holmstrom's principal-agent problem to develop an explanation of the split between salary and incentive (commission) pay. The problem is viewed as one of designing a plan that aligns incentives optimally between a risk-neutral firm and a risk-averse

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salesperson. They show that as the risk aversion of a salesperson grows, the risk-neutral firm will bear more risk by weighting more heavily the salary component of a compensation plan. All of the relevant differences between the components of compensation plans are characterized in terms of their risk-shifting properties.

Although the principal-agent formulation provides considerable insight into the problem, the reliance on risk-sharing as the sole explanatory mechanism is limiting in some respects. First, it does not afford us any insight into the possible non-risk-related explanations cited by observers of institutional practice (see Smyth). These include such factors as the relative importance of nonselling activities undertaken by salesmen and the difficulty of assessing productivity of individual salespeople.

Another limitation of the focus on risk-sharing is that a close inspection of the principal-agent solution reveals that it is not quite consistent with a salary-only plan. If a salesperson were offered a 100 percent salary package, he could shirk and still collect his guaranteed wage. Knowing this, firms would presumably not enter into such salary-only plans. Yet industry surveys (for instance, see Peck) show that about 20 percent of the firms studied use a salary-only plan for their salespeople.

In this paper, we develop a model that explains the choice between salary and contingent (output-based) compensation based on mechanisms other than risk-sharing. Basically, we utilize the coordination model of Weitzman, where prices and quantities are two available planning instruments. Our approach extends his model to allow for the assumption that contracting parties are prone to behaving opportunistically.¹

The remainder of the paper is organized into five sections. Immediately following, in section 2, we provide an introduction to the major components of compensation plans. In section 3, the model is developed, and the optimal solution is derived. Section 4 develops some comparative statics and discusses these results. Section 5 describes an empirical test of the results using data from a survey of salesforces. We conclude in section 6 with a discussion of the implications of the results.

2. SALESFORCE COMPENSATION PLAN COMPONENTS

The three most basic types of compensation used with salespeople are salaries, commissions, and bonuses. A salary is a fixed payment made to salespeople at a fixed interval (usually monthly) and is guaranteed regardless of output in that immediate past period. However, it is not true that salary arrangements lack any incentive properties as is sometimes presumed. Sal-

¹ Recently, Lazear has offered a model that compares salary compensation with contingent compensation. Unlike the present model, he views salaries as based on input or effort. Further, no empirical tests are provided of his model's results.
aries possess good incentive properties in multiperiod relationships. We will develop a multiperiod reputation argument in our model to reflect this feature of salary arrangements. In practice, about 20 percent of firms pay their sales employees on a salary-only plan. Most firms also tend to have some salary component in their compensation plans.

The second major component of salesforce compensation is the commission. This is a payment made to an employee based on a fixed formula involving realized output in the immediate past period. These formulas are generally tied to some sales or profit indicator (unit volume, dollar volume, gross margins, and the like) and are expressed in a percentage form. These percentages are sometimes constant over a range of outcomes or else increase with improvements in performance. In some instances they even decline with increased output (regressive sliding commission plans). Commission-only plans are found in about 10 percent of salesforces (Sales and Marketing Management, 1984); however, about 50 percent have some commission component within the total package (John and Weitz).

A third major component of a sales compensation plan is a bonus. A bonus is very similar to a commission in its essential content, except that the payments are calculated and made less frequently (quarterly or annually). Also, they are sometimes tied to measures of performance other than realized sales (for example, number of new accounts). We combine bonuses and commissions together because of their essentially similar nature. Because of their higher-powered incentives, we categorize commission and bonus as contingent pay, while labeling salary as noncontingent pay.

Other forms of compensation used are various benefits payments, stock options, and sales contests. In developing our model, we shall essentially ignore these other components. This is not unreasonable since salaries, commissions, and bonuses generally account for the vast majority of sales compensation expenditures. Also, these other components are usually uniformly provided to employees in a company.

3. MODEL OF SALESFORCE COMPENSATION

3.1. STRUCTURE OF MODEL

The compensation issue is characterized here as a problem of choosing between alternative means of coordinating the interaction between the firm and the salesperson. We draw heavily on Weitzman's formulation of the choice between prices and quantities as planning instruments. Briefly, we characterize contingent pay as a type of price coordination mechanism, while noncontingent pay is a type of quantity control mechanism where direct control is attempted via sales quotas and/or goals.

Consider the interaction between the firm and a single salesperson. The exchange between these parties consists of the salesperson obtaining sales orders, $q$, and, in turn, receiving compensation.
In order to generate these orders, the salesperson must make a trade-off between his effort level and the rewards associated with it. This trade-off is represented as an opportunity cost function, which is only imprecisely known to the firm because they cannot completely observe the activities of the salesperson. Rather, only the delivered sales orders, \( q \), is observable.

The sales orders that are obtained by the salesperson generate revenues. We represent the gross benefits derived from this interaction as revenues minus all the noncompensation expenses incurred. Such expenses would include production costs, as well as other nonproduction costs (inventory costs of unsold goods, costs of unmet demand, and so on). Note that these downstream benefits are also not likely to be known precisely because of the variability in the components.

The organizational coordination problem can now be posed as follows: which compensation system (contingent vs. noncontingent) is the most efficient given these uncertain benefits and costs? We propose that the firm will act so as to maximize the expected joint net benefits to both parties, while recognizing that the salesperson reacts in systematic ways to compensation incentives, depending on his preferences and trade-offs. The assumption of joint net benefit maximization is an appealing one since, as Flaherty notes, "regardless of how their profit-splitting bargaining proceeds, they will have the most to split if [the firm acts] to maximize joint net benefits" (512).

We also include consideration of the tendency of the exchange partners to breach agreements if such action is profitable. Rather than assuming faithful adherence to agreements, as is assumed by both Weitzman and Flaherty, or that breaches are easily enforced by courts, only self-enforcing agreements are considered here. (See Williamson, 1985, and Macaulay for a general discussion of the difficulty of enforcing agreements through the legal system.)

The concern for a self-enforcing agreement is particularly important for a noncontingent pay plan. It would appear that salary plans are terribly handicapped in this setting since a salesperson could breach the agreement and still collect the fixed payment, particularly if the firm cannot enforce agreements easily. We rely on a reputation effects mechanism (Klein and Leffler; Shapiro) to construct a self-enforcing salary agreement. Several characteristics of an internal labor market (Wachter and Williamson) are implicated in this approach.

3.2. ASSUMPTIONS OF MODEL

1. A single salesperson is employed by a firm to sell a single product.
2. The sales orders that are realized, \( q \), is readily observed by the firm.
3. The salesperson’s opportunity cost function is described by \( C(q, \theta) \)
where $\theta$ is a random variable to the firm. However, $\theta$ is not a random variable to the salesperson because he is considered to know his own opportunity costs precisely.

The fact that $\theta$ is a random variable to the firm indicates the presence of an information gap or asymmetry between the salesperson and the firm. To gain a clearer understanding of the meaning of $\theta$, consider one possible form of the cost function:

$$C(q, \theta) = C(q) + \theta \quad \text{where} \quad \theta \sim n(\mu, \sigma^2).$$

Here, one might think of the firm observing the salesperson's opportunity costs with error, $\theta$. Although training, socialization practices, and supervision are intended, in part, to narrow this information gap, the inability of the firm to completely monitor the salesperson's activities will result in some residual measurement error which is captured by $\theta$. In the actual analysis we use the general form of the cost function, $C(q, \theta)$.

4. The labor market for salespeople is considered to be competitive. Thus, the salesperson will not agree to work unless his reward (salary or commission) is at least equal to the opportunity cost $C(q, \theta)$, ex ante.

5. Both the salesperson and the firm are assumed to be risk-neutral. While this is similar to Lazear's assumption, it is different from the principal-agent formulation (Holmstrom; Basu et al.) where the salesperson (agent) is risk-averse while the firm is risk-neutral. Although it appears to be counterintuitive to assume that individual salespeople are risk-neutral, we do so for a particular reason. As Williamson notes, this "helps to disclose core efficiency features that go unnoticed or are misconstrued when risk-aversion assumptions are employed" (1985: 389). Our purpose here is to assume risk-neutrality in order to isolate possible non-risk-related explanations for compensation plans.

6. The gross benefits to the system derived from the sales orders (revenues minus noncompensation costs) are described by $B(q, \eta)$. $\eta$ is a random variable to both parties because the causes of variation in benefits are equally imprecisely known to both the firm and the salesperson.

7. Like Weitzman and Flaherty, we also assume that $B(q, \eta)$ is strictly concave in $q$, and $C(q, \theta)$ is convex in $q$.

### 3.3. Contingent Compensation

We describe contingent compensation as an agreement between the firm and the salesperson where a per unit payment, $p$ (a commission rate), is

2. Actually, even the salesperson may not know his own opportunity costs precisely. All that is needed is that the firm has less knowledge about these costs than does the salesperson.
agreed upon for selling the product. This formal representation of a contingent plan ignores sliding commission scales, draw accounts, and the like. We confine the model to a simple fixed-rate commission.

Formally, we can summarize the issue facing the firm and salesman as:

\[
\begin{align*}
\text{Max } & E(B(q, \eta) - C(q, \theta)) \\
\text{s.t. } & \text{Max } pq - C(q, \theta)
\end{align*}
\]

In (1), the firm maximizes the expected joint net benefits available to the two parties by selecting \(\hat{p}\), the optimal commission rate or price per unit paid to the salesman. In turn, the salesman chooses a quantity \(\hat{q}\) such that his net benefits are maximized. Note that for the firm the optimal sales orders \(\hat{q}\) is ex ante a random variable. Note also that the expectation operator is not used in equation (2) because \(C(q, \theta)\) is stochastic only from the firm’s standpoint.

It should be observed that no significant enforcement problems arise from this agreement because neither party has any incentive to breach the contract. These incentive properties are readily seen when one considers a commissioned salesforce. If a salesman shirks, he bears the consequences of such behavior in reduced commission income. It is also a single-period contract that carries no implicit expectation of repeat employment. While one may observe a firm using the same salesman over multiple periods, this is simply equivalent to a series of single-period agreements. Thus, the salesman’s income shifts to reflect changes in costs and benefits in each period.

3.4. Noncontingent Compensation

This plan differs considerably from the contingent system. Recall that in the previous case, the salesman reacted to the optimal commission rate, \(\hat{p}\), which induced the optimal output, \(\hat{q}\). In the noncontingent system, the firm and salesman agree on a fixed wage and a target quantity for a period. Clearly, there must exist some inducement for the salesman to expend the effort to deliver the target quantity rather than reduce effort and still collect the salary. We argue that salary compensation agreements are safeguarded against such behavior by an internal labor market arrangement (Williamson, 1979).

An internal labor market is an implicit long-term (or open-ended) agreement whereby the employee does not have to regain his job at the start of each period against all comers. Rather, he can expect continuing employ-
ment unless there is a severe reduction in performance. Only then is termination even considered.\textsuperscript{3}

It is this expectation of continuing employment that enables the firm to induce nonopportunistic behavior. In essence, a premium is bundled into the wage, and the salesperson will honor the agreement as long as the present value of these payments is greater than the gain from reducing effort.

Assuming a competitive labor market, we propose that a salary plan consists of an agreement between the firm and the salesperson, where the firm agrees to pay a fixed amount of money in return for productivity level or output, \( q \), on the part of the salesperson. It should be noted that the payment of the salary is not contingent on delivery of \( q \). Even if the agreement is breached by the salesperson, the period's wage has to be paid regardless. Of course, the firm can refuse to hire the salesperson for the following period.

This model of salary compensations differs from the model offered by Lazear. He proposes that salaries are an explicit function of effort. Such a plan is expressed as an hourly wage. In contrast, the present model makes no explicit connection between hours worked and salary. Lazear's formulation is more appropriate for hourly-wage employees such as factory workers. Salespeople employed by manufacturing firms are generally not paid an hourly wage. Rather, they are paid monthly salaries, which reflect anticipated productivity. These expectations about productivity are often expressed in the form of sales targets or quotas. Realized sales in relation to targets form the basis of the firm's evaluation of the salesperson's productivity.

Let \( (q-d) \) represent the point below which a contract involving \( q \) is enforceable virtually costlessly. In other words, agreements involving \( q \) can always be enforced up to \( (q-d) \) in realtime. Gaps in contractual performance are limited to \( d \). Thus, the magnitude of \( d \) indexes the relative difficulty of enforcing adherence to the agreement regarding the agreed-upon quantity, \( q \). If \( d \) is large, then agreements involving \( q \) are relatively more difficult to guarantee, and vice versa. When \( d \) is zero, these agreements are readily guaranteed to be executed faithfully. This last condition corresponds to Weitzman's original formulation.

Assume that the salesperson is dismissed if any amount less than \( q \) is delivered (that is, the inference has been made that the agreement has been breached). Upon dismissal, it is assumed that this information be-

\textsuperscript{3} A testable implication here is that salaried salespeople will tend to have relationships of longer duration than commissioned salespeople. Voluntary turnover should also be lower.
comes available to all firms, and future employment prospects are lost.\footnote{Clearly this is a restrictive assumption and is only made for convenience. Allowing for imperfect communication among firms would not change the nature of the results. All that is needed in the analysis is some reduction or partial loss in the income stream. This is reasonable because such employees would generally only be able to obtain lower-paying jobs.} From the salesperson’s point of view, his choice is between faithful adherence to the agreement concerning \( q \) and continued employment, or \( q-d \) and dismissal. Consider the gains associated with each of these two courses of action.

Let \( \overline{W} \) represent the agreed-upon wage and \( q \) the optimal sales target. If the salesperson delivers \( q-d \) rather than \( q \), the firm terminates him, although the period’s wage, \( \overline{W} \), has to be paid regardless. This income stream yields a discounted return, \( W_1 \), equal to

\[
W_1 = \frac{\overline{W} - C(q-d, \theta)}{1 + r}.
\]

where \( r \) is the discount rate that the salesperson attaches to the payment stream.

Alternatively, if the salesperson chooses to honor the agreement, he will receive a continuing stream of wage payments that yield a discounted return, \( W_2 \), equal to

\[
W_2 = \frac{\overline{W} - C(q, \theta)}{r}.
\]

Since the salesperson will choose that course of action which yields him the most return, then the payment, \( \overline{W} \), must be such that the returns from honoring the agreement are greater than the returns from breaching it \( (W_2 > W_1) \), or

\[
\overline{W} \geq (1+r)C(q,\theta) - rC(q-d,\theta).
\]

Such a payment, \( \overline{W} \), can be seen to consist of two components. First, by virtue of a competitive labor market we know that once the optimal target quantity \( q \) is known, a competitive level of payment, \( \overline{W} \), must be paid that is equal to the opportunity cost

\[
\overline{W} = C(q,\theta).
\]
The other component of \( \overline{W} \) is an "excess" payment over the competitive wage, \( \overline{W} \), that must be included to induce nonshirking behavior. This payment, or premium, \( \pi \), is equal to

\[
\pi(\hat{q}, \theta) = \overline{W} - \overline{W} = r[C(\hat{q}, \theta) - C(\hat{q} - d, \theta)].
\]  

This premium exists to guarantee, ex ante, that the salesperson's output is known to the firm. Both Weitzman and Flaherty also employ this assumption that output is known, ex ante, with noncontingent plans. However, they presume that agreements will be faithfully executed. We allow for opportunistic behavior. Note that if the zone \((\hat{q} - d, \hat{q})\) where contract breaches are costly to enforce were to vanish \((d = 0)\), then the associated premium would also disappear. The problem then reduces to Weitzman's original formulation. Thus, \( \pi \) can be construed to be a cost arising out of the imperfect enforceability of contracts.

We can now describe the noncontingent coordination problem as follows:

\[
\begin{align*}
\text{Max } E[B(q, \eta) - C(q, \theta) - \pi(q, \theta; d, r)] \\
q \\
\text{s.t.} \\
\pi(q, \theta; d, r) = r[C(q, \theta) - C(q - d, \theta)]
\end{align*}
\]  

\[ (4) \]

3.5. Optimal Compensation

To derive the optimal compensation agreement we begin by solving the two problems separately. Next, a method is devised for comparing solutions in order to determine an optimal agreement. Although this procedure is identical to Weitzman's approach, it should be noted that the problem itself is quite different, because of the premium involved. In fact, the solution differs considerably as a consequence.

With respect to the contingent compensation problem, equations (1) and (2) can be solved by recognizing that from (2) we have:

\[
p = C_1(\hat{q}, \theta)
\]

i.e., \( \hat{q} = h(p, \theta) \)  

\[ (5) \]

\[ (6) \]

Thus, (1) can be written as

\[
\begin{align*}
\text{Max } E[B(h(p, \theta), \eta) - C(h(p, \theta), \theta)] \\
p
\end{align*}
\]  

\[ (7) \]

Using the first order condition, we have

\[
E[B_1(h(p, \theta), \eta) \cdot h_1(\hat{p}, \theta)] = E[C_1(h(\hat{p}, \theta), \theta) \cdot h_1(\hat{p}, \theta)]
\]
but from (5) and (6),

\[ p = C_1(h(p, \theta), \theta) \]

i.e., \[ \hat{p} = C_1(h(\hat{p}, \theta), \theta) \]

i.e., \[ \hat{p} = \frac{E[B_1(h(\hat{p}, \theta), \eta) \cdot h_1(\hat{p}, \theta)]}{E[h_1(\hat{p}, \theta)]} \]  

(8)

Corresponding to the optimal ex ante commission rate \( \hat{p} \) is the ex post profit-maximizing output \( q \) where

\[ q(\theta) = h(\hat{p}, \theta). \]  

(9)

Behaviorally, the firm is picking the commission rate \( \hat{p} \) that induces the salesperson to produce the optimal expected sales level, \( \hat{q} \). This maximizes the expected joint net benefits to the system under the commission arrangement.

For the salary problem, the optimal quantity, \( \hat{q} \), that maximizes the objective function can be solved from the first order condition for equation (4):

\[ E[B_1(\hat{q}, \eta) - C_1(\hat{q}, \theta) - r C_1(\hat{q}, \theta) + r C_1(\hat{q} - d, \theta)] = 0. \]  

(10)

An optimal compensation agreement can be determined by comparing the expected joint net benefits that are achieved under each compensation plan. This is done by defining the difference in expected joint net benefits, \( \Delta \), as the comparative advantage of the contingent plan over the noncontingent compensation agreement.

Define \( \Delta = E[B(\hat{q}(\theta), \eta) - C(\hat{q}(\theta), \theta) - \{B(\hat{q}, \eta) - C(\hat{q}, \theta) - \pi(\hat{q}, \theta)\}] \)  

(11)

This is simply the difference in the value of the two objective functions at their respective optimal solutions. One method for effecting a comparison is to express one solution in terms of the other. Thus, the analytic strategy is to express the solution to the contingent plan \( (\hat{q}, \hat{p}) \) in terms of the solution to the noncontingent plan \( (q) \). We have arrived at a derivation which uses this strategy to re-express the comparative advantage in the following, more interpretable form:

\[ \Delta = \frac{\sigma^2}{2C'} \left[ B'' + 1 \right] + \frac{(rC''d)^2}{2(C'' - B''')} + rC'd - \frac{1}{2} \frac{rC''d}{(C'' - B''')} \]  

(12)

where

\[ C' = C_1(q, \theta) \]

\[ C'' = C_{11}(q, \theta) \]

\[ B'' = B_{11}(q, \theta) \]

5. The complete derivation, not published here, can be obtained from the authors upon request.
and where $\sigma^2$ is the variance of $\theta$. This is the fundamental result of the paper. In the following sections we examine this equation in order to understand the conditions under which each type of compensation plan is preferred. Note that in all of the following instances, when $\Delta$ becomes smaller, noncontingent arrangements become relatively more efficient than contingent compensation, and vice versa.

4. IMPLICATIONS

In this section, we shall address the implications of the model. Since our interest involves empirical tests of the model's results, we shall translate the comparative statics results into propositions involving empirically observable surrogates for the model's parameters. Further details about the actual measures to be used are provided later in section 5.

4.1. CONCAVE BENEFIT FUNCTIONS

Inspecting the expression for $\Delta$, it is clear that $B''$, the concavity of the benefits function, will significantly affect the comparative advantage of commissions over salary payments.

Deriving $\frac{\delta \Delta}{\delta B''}$, we have

$$\frac{\delta \Delta}{\delta B''} = \frac{\sigma^2}{2(C''')^2} + \frac{(rC''d)^2}{2(C'' - B'')^2}.$$

Since $C'' > 0$, $B'' < 0$ (by assumption),

then, $\frac{\delta \Delta}{\delta B''} > 0$

i.e., as $B'' \to -\infty$, $\Delta \to -\infty$.

Thus, as expected gross benefits become more concave around the optimal quantities, this favors the use of noncontingent (salary) compensation over contingent (commission) arrangements.

In discussing the shape of expected benefits, Weitzman notes that their concavity around the optimal quantity increases when the activity in question is less substitutable for other activities, that is, the activity being coordinated is more of a fixed-proportions factor. Several situations can be identified that increase the fixed-proportions nature of sales activities.

Suppose, for instance, that a firm faces very high inventory costs of unsold goods. Then, very slight imbalances between production and sales ac-
tivities can greatly reduce profitability. In such a case, rather than allow salespeople to react to a commission rate, it is better to directly agree to a sales target (and pay salaries). As another example, consider a firm in a situation where after-sales service and maintenance are very important. In such situations, exceeding optimal sales targets may lower the quality of service that can be delivered, resulting in dissatisfied customers.

In each instance, the common thread is a need for tighter coordination of the sales activity (and the associated target sales) with production and other nonselling activities. We shall capitalize on this notion of coordination needs to measure the fixed-proportions nature of the benefit function. Summarizing, we have:

**Proposition 1:** As the coordination needed between selling and nonselling activities increases, salary compensation will be relatively more efficient than contingent compensation.

### 4.2. INFORMATION ASYMMETRY

Inspecting (12), it is evident that \( \sigma^2 \), the variance of \( \theta \), represented the magnitude of the asymmetry of information between the firm and the salesperson regarding the opportunity costs of the salesperson.

Differentiating (12), we have:

\[
\frac{\delta \Delta}{\delta \sigma^2} = \frac{1}{2C''} \left[ \frac{B''}{C''} + 1 \right]
\]

We then have the following results:

(a) \( \frac{\delta \Delta}{\delta \sigma^2} > 0 \) if \( B'' \) is close to 0,

(b) \( \frac{\delta \Delta}{\delta \sigma^2} < 0 \) if \( B'' = > - \infty \).

The effect of greater informational asymmetry is to reinforce the extant optimal contract type. In other words, if a salary plan is preferable because of a highly concave benefit function, then a higher \( \sigma^2 \) value reinforces this effect. Likewise, if a commission plan is preferable, higher \( \sigma^2 \) values reinforce its efficiency.

To translate \( \sigma^2 \) into an observable measure, one might think of the firm as observing the salesperson’s opportunity costs with some error, \( \theta \). As we argued earlier, this error was diminished by the extent to which the firm could monitor or otherwise supervise the salesperson’s activities. Thus, the
firm's inability to supervise can serve as an empirical surrogate for $\sigma^2$. The comparative statics results involving informational asymmetry can now be stated as follows:

**Proposition 2:** There is an interactive effect on compensation between the inability to supervise activities and the coordination needs of selling and nonselling tasks. Specifically, when these coordination needs are low, an increased inability to supervise salespeople leads to salary compensation being relatively less efficient. However, when these coordination needs are high, an increased inability to supervise salespeople leads to salary compensation being relatively more efficient.

This is a rather distinctive result of this model. The intuition behind this can be described in the following manner. When variations in realized sales around the optimal quantities do not harm benefits significantly, it is not worth paying the premium bundled into salaries. However, when such variations have significantly deleterious effects on benefits, it is well worth it to pay such a premium. Allowing salespeople to react to declared commission rates could result in intolerable reductions in benefits.

4.3. **Marginal Opportunity Costs**

Equation (12) reveals that it is the derivative or slope of the opportunity cost function, $C(q, \theta)$, that is involved in the comparison of the two plans. Differentiating $\Delta$ with respect to $C'$, we have:

$$\frac{\delta \Delta}{\delta C'} = rd$$

As $r > 0$, $d > 0$, we have $\frac{\delta \Delta}{\delta C'} > 0$.

An observable measure of $C'$ can be developed by noting that $C(q, \theta)$ describes the trade-offs made by the salesperson between effort and the rewards associated with the effort. As such, one can then consider the slope of this function to consist of the amount of effort needed to generate additional sales. Thus, a low value of $C'$ would occur in a situation where a salesperson finds it relatively easier to generate additional sales because, for instance, the product might be in high demand by customers. Conversely, if the product is difficult to sell, then a higher value of $C'$ is warranted. We shall capitalize on this notion of the intensity of demand for the product to develop an empirical surrogate.
In the above analysis, we see that when a higher degree of effort is needed to make additional sales, commission compensation becomes favored over salary compensation. Intuitively, this happens because the premium bundled into salary compensation is becoming larger under these circumstances. Note that the gain from breaching a salary agreement is greater when high levels of additional effort are needed. Hence, a larger premium is warranted. Summarizing, we have the following:

**Proposition 3:** When effort levels needed to make additional sales increase, commission compensation becomes relatively more efficient than salaries.

### 4.4. Contract Enforcement Difficulty

In the model, $d$ indexes the difficulty of enforcing contracts. Recall that the zone $(\hat{q}, d, \hat{q})$ was the region where contracts were not easily enforced. In order to assess the impact of changes in $d$, we derive $\frac{\delta \Delta}{\delta d}$ as follows:

$$\frac{\delta \Delta}{\delta d} = r \left[ C'' d \left( \frac{rC'''}{C'' - B''} - 1 \right) + C' \right].$$

Inspecting the expression above, it is difficult to sign it unambiguously. However, by making certain assumptions we can obtain some insight into the effects of $d$. For a large number of selling situations it is reasonable to assume that both $C''$ and $d$ are relatively small. A small value of $C''$ means that the opportunity cost function is a gentle curve in the region around the optimal quantity, $\hat{q}$. Behaviorally, this means that salespeople do not face any fixed constraints that prevent them from increasing sales. This might not be the case if, for instance, a territory were at its saturation level of sales. Barring such circumstances, a small value of $C''$ is warranted. A small value of $d$ means that the zone $(\hat{q}, d, \hat{q})$ is relatively small compared to the sales level, $\hat{q}$. Behaviorally, this means agreements are not breached in a gross manner. We are only concerned about marginal shading. This is reasonable since we are dealing with employees in a vertically integrated situation. Gross breaches are more plausible when independent agents are involved.

Given these assumptions, we have the following results:

(a) $\frac{\delta \Delta}{\delta d} < 0$ if $C'$ is small,

(b) $\frac{\delta \Delta}{\delta d} > 0$ if $C'$ is large.
An empirical surrogate for \( d \) can be developed if one considers that the difficulties associated with contractual agreements arise because of the need to infer degree of adherence from the realized sales quantities. Even though the output quantity itself is readily observable, the firm might not be able to attribute it unambiguously to the particular salesperson because of team selling, overlapping territories, and so forth. Consequently, the inferences about salesperson productivity that are made from observed quantities involve some degree of error. This creates the enforcement problem.

In the derivation above, it can be seen that the effect of contract enforceability on compensation depends on the effort levels needed to generate additional sales. When such effort levels are relatively small, salary compensation is more efficient than commission as it becomes more difficult to enforce agreements. However, this result is reversed when additional sales require relatively higher effort levels. We can summarize these results as follows:

**Proposition 4:** There is an interactive effect on compensation between the effort levels needed for additional sales and the difficulty of enforcing agreements. Specifically, when these effort levels are relatively small, an increased difficulty in enforcing adherence to agreements makes salary compensation more efficient than commission plans. However, when these needed effort levels are high, the effect of contract enforceability on compensation is reversed, and salary compensation is less efficient than commission plans.

5. **EMPIRICAL STUDY**

5.1. **RESEARCH DESIGN**

The propositions derived above are tested here with data from a survey of salesforce compensation plans across a broad crosssection of manufacturing firms. Manufacturing firms are a good context for assessing the expectations since the compensation plans used by these firms conform quite well with the model’s representation. For instance, these firms do not pay hourly wages for their salespeople, as other firms such as retailers do with their sales clerks. Furthermore, large variations in compensation plans are known to exist here.

Briefly, the sample was obtained in the following manner (see John and Weitz for further methodological details). A list of sales executives (managers and/or vice-presidents) in manufacturing firms with annual sales over $50 million were purchased from a commercial broker. A letter was sent to these individuals from the researchers requesting participation in the
study. A total of 266 firms initially agreed to participate in the survey. A questionnaire was mailed to these 266 firms. It should be noted that firms often have multiple salesforces with different compensation plans for each salesforce. When a respondent wished to respond to the questionnaire for more than one salesforce, we mailed additional questionnaires to them. In the final data, three firms provided information for two salesforces each. All other firms provided information about a single salesforce in the firm. In total, 161 salesforces participated in the survey.

The questionnaire was followed up with telephone calls to resolve ambiguous responses and to fill in missing information. Despite our efforts, some firms did not supply the relevant information for some of the variables of interest. Consequently, the sample sizes will vary in the hypothesis tests that are described later.

5.2. CHARACTERISTICS OF SAMPLE

Our sampling procedure yielded a pool of data that appears quite comparable to the samples used in other widely referenced empirical studies of salesforce compensation (Peck; Steinbrink & Freedman). Comparing our sample to the Dartnell survey reported by Steinbrink and Freedman, their respondents are from smaller firms with less-experienced and lower-paid salespeople. Likewise, the Conference Board survey reported by Peck has a larger average firm sales volume. As table 1 shows, the annual sales per salesperson, average age, and types of compensation plan used are quite similar across the samples.

<table>
<thead>
<tr>
<th>Table 1. Compensation Survey Samples</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Number of responses</td>
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<tr>
<td>Number of salespeople per salesforce (median)</td>
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<tr>
<td>Annual sales volume (median)</td>
</tr>
<tr>
<td>Annual sales per salesperson (median)</td>
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<tr>
<td>Age of salespeople (average)</td>
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<tr>
<td>Salary-only plans</td>
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<tr>
<td>Commission-only plans</td>
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<tr>
<td>Compensation per salesperson (average)</td>
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<sup>a</sup> Mean for average performing salespeople.
<sup>b</sup> Mean for experienced salespeople.
5.3. Measures

We developed empirical measures for each of the variables implicated by
the propositions advanced earlier. Each of these measures is described
below.

Compensation plan: Although the model discretizes compensation
plans into commission plans and salary plans, we have chosen to recast this
in a continuous form for purposes of empirical testing, since the vast major-
ity of firms use a combination of commissions and salaries. We derived an
estimate of the proportion of total salesforce compensation that is salary
compensation (PROPSAL) from the amounts of dollar salary compensation
and total dollar compensation paid to the salesforce as reported by our
respondents.

Concave benefit functions: Recall that we identified increases in the
concavity of the benefit function (B") to correspond to more interdepen-
dence between selling and nonselling activities. In turn, this necessitated
more coordination between these sets of activities.

To develop an operational indicator of this notion of coordination, we
identified post-sales problems and after-sales service as the major nonsell-
ing activities that might have to be coordinated with selling activities. In
doing so, we recognize that there are other nonsales activities such as ad-
vertising and promotion that might have been considered. Generally, these
latter activities are not coordinated at the level of the salesperson. For in-
stance, advertising plans are drawn up at a regional or national level. While
the advertising plan and the overall sales plan are obviously tightly coordi-
nated, the individual salesperson’s job is unaffected by this higher-level
process.

Based on this line of reasoning, this variable was operationalized via the
following item. Using a 7-point strongly disagree—strongly agree format,
each respondent was asked to respond to the following statement: “These
salespeople have to coordinate very closely with other company employees
to handle post-sales problems and service.”

Higher values of this item (COORD) mean that the interdependence
between the selling and nonselling function has increased. In other words,
the sales activities are becoming more of a fixed-proportions factor.

Informational asymmetry: In discussing this asymmetry of information
about the salesperson’s opportunity costs (σ²), we saw that this could be
operationalized as the degree to which the firm could not supervise the
salesperson’s activities. Such an inability to supervise salespeople can arise
because salespeople may have to travel to the customer’s worksite, and it is
not practical to have a supervisor present. However, it should not be con-
strued that firms have no means of assessing the activities of a salesperson.
The “call reports” required of salespeople, territory-workload analyses, and
customer audits by supervisors are all devices intended to provide the firm with information about the salesperson's activity level. Based on this reasoning, we asked the respondents to evaluate the firm's overall ability to supervise salespeople via the following statement (the response was recorded on a 7-point strongly disagree—strongly agree format): "It is just not possible to supervise these salespeople closely." Higher values of this item (ASYMM) correspond to a greater degree of information asymmetry that exists between the firm and the salesperson.

**Marginal opportunity costs:** Recall that we argued that this parameter ($C'$) could be operationalized by the amount of effort needed to generate additional sales. When such effort levels are great, the salesperson faces relatively greater marginal opportunity costs. To develop an operational indicator of these marginal effort levels, we identify situations where sales are relatively easier to make. While many factors (for example, product uniqueness, lack of alternative sources of supply) can make a product relatively easier to sell, a reasonable way of summarizing these factors is to think in terms of the customer's intensity of demand, or need, for the product. Obviously, when a customer needs a product more, it becomes easier to sell, and vice versa.

It should be noted that the above line of reasoning is actually using an average level of such effort as an approximation to the marginal level of effort needed for sales. We asked our survey respondents to evaluate the following statement: "The customer needs the salesperson's product." The response format for this item is different from the other measures. Rather than using the agree—disagree format, the instructions requested them to evaluate "the percent of time the statement applies to sales situations encountered by your salespeople." Their responses were noted on a 0—100 percent scale. The actual responses to this measure (MRCOPP) were reverse-coded prior to estimating the regression, so that higher values would correspond to greater, rather than lower, levels of marginal effort required to make additional sales.

**Contract enforceability:** The $d$ parameter indexed the degree of difficulty faced by a firm in enforcing its agreements with the salesperson regarding the agreed-upon quantity, $q$. Recall that we argued that an empirical surrogate for $d$ can be derived if one considers the fact that enforceability with respect to agreed-upon quantities is more difficult to achieve when valid measures of output attributable to the salesperson are not readily available. For instance, the firm might observe sales but be unable to attribute it to a particular salesperson because of team selling efforts involving multiple salespeople. In other instances, overlapping territories of salespeople can make it difficult to link achieved results to specific salespeople. Finally, long selling cycles make it difficult to measure volume accurately, since effort and results are separated by lengthy time periods.
In each of these situations, it is the lack of availability of accurate measures of the volume attributable to each salesperson that make the productivity inferences ambiguous. We capitalize on this notion of accurate measures at the individual salesperson level to develop the empirical indicator.

Our measure of this variable \( (D) \) asked the respondents to evaluate the following statement on a 7-point strongly disagree—strongly agree format: “We have accurate measures of each of these salespeople’s volume.” The responses to this item were reverse-coded prior to analysis, so that higher values of \( D \) would correspond to a greater difficulty of enforcing agreements.

5.4. HYPOTHESIS TESTS

Our strategy for testing the propositions consisted of estimating regression models that correspond to the statements. In all cases, statements regarding the significance of directional hypotheses are made on the basis of 1-tail tests at the 0.10 level of significance.

Proposition 1: Table 2 displays the results of a regression model that addresses the validity of this proposition. As hypothesized, a greater degree of interdependence between selling and nonselling activities (COORD) significantly increases the proportion of salary compensation (PROPSAL) paid to these salespeople \( (b=0.022, \ t=1.46) \).

Proposition 2: Recall that this proposition involved an interactive effect of information asymmetry (ASYMM) and interdependence between selling and nonselling activities (COORD). This interaction is described by the following regression model:

\[
\text{PROPSAL} = a_1 + b_1 \text{ASYMM} + b_2 \text{ASYMM} \times \text{COORD} \tag{13}
\]

where DCOORD is a dummy variable that equals 1 in the high interdependence situation and 0 in the low interdependence situation. The cutpoint for those categories is the mean value of the COORD measure.

<table>
<thead>
<tr>
<th>Table 2. Statistical Model for Proposition 1</th>
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<tbody>
<tr>
<td>N = 140</td>
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<tr>
<td>Dependent Variable: PROPSAL</td>
</tr>
<tr>
<td>Independent Variables</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>COORD</td>
</tr>
<tr>
<td>R² adj.: 0.01</td>
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*Significant at \( \rho = 0.10 \) (1-tail)
**Significant at \( \rho = 0.05 \) (1-tail)
The proposition is tested via the significance of the two coefficients of the independent variables in the above regression equation. When interdependence is low (DCOORD=0), the effect of increased asymmetry resulting in less use of salary compensation is described as a negative $b_1$ coefficient. As interdependence increases, this effect is expected to change in a positive direction. In the regression, the $b_2$ coefficient captures this expected change in slope of the asymmetry variable between the conditions of low and high interdependence. Thus, the $b_2$ coefficient should be positive.

Table 3 displays the estimated coefficients. As hypothesized, $b_1$ is significantly negative ($b_1 = -0.033, t = -1.96$), and $b_2$ is significantly positive ($b_2 = 0.035, t = 2.37$). Thus, proposition 2 finds support in the data.

Proposition 3: In this proposition, we hypothesized that increases in marginal opportunity costs (MRGOPP) favored less salary compensation (PROPSAL). Table 4 displays the estimates for the regression model corresponding to this hypothesis. As hypothesized, the proportion of salary compensation is reduced when it is more difficult to make additional sales ($b_1 = -0.001, t = -1.374$).

Proposition 4: Similar to proposition 2, this involved an interaction hypothesis. Specifically, it posited an interactive effect of contract enforceabili-

<table>
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<th>Table 3. Statistical Model for Proposition 2</th>
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<tr>
<td>N = 140</td>
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<tr>
<td>Dependent Variable: PROPSAL</td>
</tr>
<tr>
<td>Independent Variables</td>
</tr>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>ASYMM</td>
</tr>
<tr>
<td>ASYMM*DCOORD</td>
</tr>
<tr>
<td>R² adj.: 0.03</td>
</tr>
<tr>
<td>**Significant at p = 0.05 (1-tail)</td>
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<th>Table 4. Statistical Model for Proposition 3</th>
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<td>N = 138</td>
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<tr>
<td>Dependent Variable: PROPSAL</td>
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<tr>
<td>Independent Variables</td>
</tr>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>Constant</td>
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<tr>
<td>MRGOPP</td>
</tr>
<tr>
<td>R² adj.: 0.01</td>
</tr>
<tr>
<td>*Significant at p = 0.10 (1-tail)</td>
</tr>
<tr>
<td>**Significant at p = 0.05 (1-tail)</td>
</tr>
</tbody>
</table>
ity \((D)\) and marginal opportunity costs \((MRGOPP)\). This interactive effect is assessed by the following regression model:

\[
PROPSAL = a_1 + b_1 D + b_2 D \times DMGOPP
\] (14)

where \(DMGOPP\) is a dummy variable that equals 1 in the high opportunity cost condition and equals 0 in the low opportunity cost condition. The cut-point for these categories is estimated as the mean value of the marginal opportunity cost measure \((MRGOPP)\).

The proposition is tested via the significance of the two coefficients of the two independent variables in the regression equation. When marginal opportunity costs are low \((DMGOPP=0)\), the expectation that an increased difficulty in enforcing agreements leads to more salary compensation is described by a positive \(b_1\) coefficient. As opportunity costs rise, this effect is expected to change in a negative direction. The \(b_2\) coefficient captures this expected change in the slope of the enforcement difficulty variable between the conditions of low and high marginal opportunity costs. Thus, the \(b_2\) coefficient should be negative.

Table 5 displays the results of the estimation. Examining the coefficients, we see that \(b_1\) is in the expected positive direction. However, this effect is not statistically significant \((b_1=.010, t=.426)\). As for the \(b_2\) coefficient, it is seen to be in the expected negative direction. Furthermore, this effect is statistically significant \((b_2=-0.05, t=-2.09)\).

6. CONCLUSIONS

Although there is a rather large literature on compensation-related issues, only limited theoretical work has focused on the choice between different types of compensation.\(^6\) The present approach is distinguished quite sharply from the agency theory models (for example, Holmstrom) by its

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<th>Table 5. Statistical Model for Proposition 4</th>
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<tr>
<td>N = 138</td>
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<tr>
<td>Dependent Variable: PROPSAL</td>
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<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Coefficient</th>
<th>T-value</th>
</tr>
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<tbody>
<tr>
<td>Constant</td>
<td>0.726</td>
<td>17.428**</td>
</tr>
<tr>
<td>D</td>
<td>0.010</td>
<td>0.426</td>
</tr>
<tr>
<td>D*DMGOPP</td>
<td>-0.050</td>
<td>-2.087**</td>
</tr>
<tr>
<td>R² adj.: 0.02</td>
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**Significant at \(p = 0.05\) (1-tail)

6. Exceptions include Lazear and Basu et al.
assumption of risk-neutrality. In the agency approach, even multiperiod analysis (see Townsend) relies on differential risk aversion to drive the results. While risk-neutrality is quite possibly a counterfactual assumption, it permits us to address the impact of factors such as information asymmetry, opportunity costs, and contract enforcement difficulties.

Lazear has presented a model of wage and piece-rate compensation that is closer to the present model than the agency approach. It involves some common factors such as the difficulty of observing salesperson activities. It differs in that he models salaries as a function of effort, whereas salaries are not explicitly a function of effort in the present model.

While the relative merits of these different models are debatable, it is noteworthy that the extant literature offers no empirical testing of any specific model. Viewed in this light, the empirical aspects of the present paper are particularly significant. We developed operational indicators for each one of the parameters in the model and gathered data from a survey of firms in order to test the propositions from the model. The four propositions involved six statistical tests of estimated effects. Of these, only one was not significant in the expected direction. Thus, propositions 1, 2, and 3 found strong support in the data, and proposition 4 found partial support.

Aside from the support that it provides for the model’s results, the empirical study demonstrates that it is possible to develop operational measures for a complex model of this type and obtain data on such measures from a carefully chosen context that permits the researchers a good opportunity to falsify the model. This is a much stronger approach than appealing to casual empiricism or utilizing aggregate-level secondary data to support conclusions from such analytic models. The extant literature is virtually devoid of empirical tests (see Murphy for a notable exception).

There are some striking parallels between the present model and the insights provided by transactions costs analysts. For instance, Wachtler and Williamson (1978) and Williamson (1985) imply that salaries (wage compensation) exist within multiperiod settings where reputation and repeat employment are important features of the setting. The present analysis differs from transactions cost analysis principally in the degree of formalization. In order to model the argument mathematically, a good deal of institutional detail is sacrificed. Despite these tradeoffs, it is encouraging to note that the model’s predictions are supported by real world data.

REFERENCES
